aerial parts of the plant were not extensive, they already contained much of the phosphorus necessary for full growth and development. It may be necessary to grow *D. whittakeri* in phosphorus-free soil for several generations if the phosphorus story with insects is to be resolved. I do think, however, that insects will play an important role in the phosphorus nutrition of this species. This suspicion is enhanced by the data obtained for plants of *D. whittakeri* which put out lateral stems. Lateral stems form in the tubers at the end of the growing season and so this is a form of asexual reproduction in this species. Plants producing lateral stems have a much higher total phosphorus level than plants not producing lateral stems and at senescence are left with two tubers with a total phosphorus content of 80-100 micrograms. Hence, wheatgrowers using *Drosera* have both an automatic insecticide system as well as an automatic phosphate fertilizer system all in one. The form of phosphorus was investigated and found to be organically bound in inositol hexaphosphate, i.e. phytin.

A similar growth experiment was carried out again using *D. whittakeri* except that a sulfur-deficient medium was used. The results confirmed the previously described experiment, i.e., there was no enhancement of growth under full nutrient conditions when insects were supplied. There was enhancement of growth in the distilled water and nitrogen deficient media when insects were supplied.

(To be continued)

Propagating *Nepenthes* with Maximum Efficiency

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Lately, within the last few years, an increasing demand for *Nepenthes* has become evident. In fact, it seems that a revival of the Victorian botanical movement has occurred. A few commercial sources are available but prices are often discouraging to many beginners.

The conventional method for producing new plants by rooting stem cuttings, often in excess of 3 or 4 nodes, some over 6 nodes per cutting, is considerably inefficient in view of the fact that each node is potentially a new plant! To complicate matters a little, if a few of these cuttings do not root well, or just rot instead, it is all the less efficient and fewer plants are available, driving the prices of the remaining plants still higher. Furthermore, if and when the conventional cuttings root, the new roots must support often more than one new stem when more than one axillary bud becomes activated; this puts a considerable amount of strain on the newly developing root system. Then the nutrients must travel from the new roots (on the old stem) up through the old stem, and across a vascular tissue "bridge" to support the new stem developing from the axillary bud. The ideal situation would be to have roots directly from the stem which it supports. But this involves raising plants from seed, or a technique that I have been developing over a period almost two years on various plants (*Nepenthes* and non-CPs).

If commercial sources were able to turn out many more plants, then hopefully the prices would drop down according to the law of supply and demand. Then perhaps more beginners would be able to get a chance at growing *Nepenthes*, and possibly even get a chance to produce a hybrid or two! It would also be quite desirable if the commercial sources were to turn out healthier and more strongly rooted plants so that beginners might not become too discouraged by losing a plant or two that were relatively weakly rooted to begin with. Commercial sources on the other hand would be able to realize a greater

turnover with fewer losses from fewer stock plants which would occupy less greenhouse space.

First, remove the apical meristem (the tip cutting) by removing just 3 nodes under the visible top closed leaf. This part of the stem should be mature enough. Removing a cutting too close to the apical meristem may lead to complications as the stem is "soft" and immature and very susceptible to disease; also a hormone problem is involved. The concentration of hormones at the apical meristem is such that root development will be inhibited. I usually root this apical cutting in a usual manner in live sphagnum tips in a small, clear pastic cup with a drainage hole cut out at the bottom. This cutting can be difficult as the embryonic leaves occasionally develop a rot in 100% humidity. If such a rot develops, simply break off those leaves and remove them from the plant. The apical meristem may have to be removed if the rot becomes severe enough — but new stems will emerge from the existing lateral buds. Lowering the humidity a little on just these plants may be desirable to inhibit fungal infections. Unless absolutely necessary, I would discourage fungicide use as they kill the sphagnum.*

After a period of about two weeks, the original stock plant (with the apical meristem or cutting removed) will begin to activate one or more of the top lateral buds (on the stem, near the base of the petiole facing the leaf). If left alone, only a few of the temporarily activated lateral buds will develop fully into a new stem and assume dominance over the lower lateral buds. When the topmost bud develops just two "scale" leaves (without pitchers) that are about an inch in length, remove just that one node, along with the adjacent portion of stem by cutting the stem just above the next lower node (This is a leaf bud cutting. Ed.), and place it in a small pot (or plastic cup, styrofoam or clear plastic) containing live sphagnum preferably, burying the *entire old stem,* so that only the scale leaves protrude through the surface of the sphagnum-filled pot. The old leaf petiole on the stem may be cut to ½ its original length.

I prefer to root my *Nepenthes* cuttings in large (100 gal) fish tanks (or terrarium tanks) with a glass (or plexiglass) cover on top creating an atmosphere of 100% humidity. The pots stand on red bricks on the bottom of the tank, with a layer of water almost up to the top of the bricks but not touching the pots. The pots will seldom have to be watered in this tank after initial placement. The rooting cuttings can be illuminated by either fluorescent lamps, or *indirect* sunlight. Photo period should be between 12 to 16 hours daily. Caution: *Never* allow the tank of rooting cuttings to be exposed to direct sunlight with the cover on. In fact, it is best not to allow direct exposure to full sunlight at all. Direct sunlight would cause a "greenhouse" effect and dangerously high temperatures within a very short time. This accumulation of heat must be avoided. I have best results maintaining just room temperature (68° to 80° F) inside the tank. After two new pitchers are produced from the rooting cutting, a mild dose of fertilizer can be applied (about ½ the strength recommended by the manufacturer). As far as sphagnum goes — I recommend using the coarsest, densest strands available; the "coarser the better" is a good rule of thumb. I prefer live sphagnum over dried. However, some may prefer to use dried sphagnum for convenience or for sanitary reasons. I also recommend inorganic fertilizers as they

* In CPN 1(4):55 (1973) Henry Demmink describes a method of propagation *Nepenthes* that begins in a similar manner but differs in what happens to the rest of the stem after apical meristem removal.

have less chance of being contaminated with fungus or bacteria.

After three new pitchers are formed on the new growth, the plant is ready to be transplanted into a larger pot containing coarse sphagnum with 10% aggregate such as peat (again, I have best results with German Peat) or osmunda fiber, or fine tree fern fiber.

As each node of the original stock plant that you have "topped" (going down the stem) becomes activated enough so that it has produced two scale leaves, it can be removed (removing only one node per cutting) making sure that a conspicuously swollen node is left on the stem below it. There may be a point on the stem where the nodes may have difficulty becoming activated, especially on old woody stems. Leaving a swollen node behind each time will ensure that the stock plant can still recover, and produce another stem of its own. This cutting down of the stem, working off each node of the stem, occasionally causes the stem to produce a burst of basal rosettes that surface near or just below the surface of the potting medium. If this occurs, any remaining nodes that can be removed for rooting should be taken from the old stem, leaving behind basal rosettes to become future stock stems.

As the new cuttings mature, roots will eventually emerge from the bottom of the new bud stem, near the point where it grew out of the old stem. This will produce a healthier plant compared to conventional cuttings.

These single node cuttings seem to root quicker than conventional cuttings, too.

To sum up the process, we first remove the tip cutting (apical meristem) and then proceed to remove each node separaely as it becomes activated enough, leaving behind and below it one node which is obviously swelling in size, unless a basal rosette has surfaced from a lower portion of the stem, in which case the entire stem can be worked off. Each cutting is rooted in a separate container of coarse sphagnum. I prefer *not* to use *any hormones* or *fungicides* on these cuttings at all. They are all placed in large (100+ gal) glass tanks with a layer of water at the bottom. The small pots are elevated just above the surface of the water, and a cover is placed on top of the tank.

The cuttings will initially root from the old stem. However, as the plant matures, roots will emerge from the lowermost portion of the new bud stem; this is why this area must be below the surface of the sphagnum. I have been successful using this technique on: 1) *Nepenthes hirsuta,* 2) *N. spectabilis,* 3) *N. ventricosa,* 4) *N. albo-marginata,* 5) *N. dyeriana,* 6) *N. alata,* 7) *N. maxima,* 8) *N. tentaculata,* 9) *N. kampotiana,* and several common hybrids at a 100% success rate (no losses in two years). Caution must be exercised when dealing with plants that are still in juvenile form which have a very tightly compact basal rosette. I would recommend waiting until these plants are mature enough to produce an erect spike stem at least six nodes long (each node at least ½ inch in length) before attempting to implement this technique.

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SPECIAL NOTICES

J. A. Mazrimas will be the coordinator of the CP Section at the California Spring Garden Show at Lake Merritt Park, Oakland. The show will run for 10 days beginning 28 April, 1978. Admission.

Lynn Macey of the Carnivorous Plant Information Service announces that by the time you read these words, the Plant List will have been sent out. If you ordered one and have not received it, please drop him a line. Also, send him your latest updates as soon as possible plus $1.00 if you want a copy of the list.